the present century stuffed specimens in most museums were far from resembling the living animals, and it is only somewhat recently that care has been taken to copy nature as closely as possible.

We are glad to see that Mr. Browne gives the late Mr. E. T. Booth, of Brighton, the credit which is due to him of being the first to start a museum in which the birds were mounted surrounded by accessories closely copied from nature—an example that has been followed not only by the Natural History Museum at South Kensington, but by many other provincial museums in England and also abroad.

A full list of nstruments he considers necessary is given, together with illustrations; but a first-class workman would, we think, be able to dispense with several of those named, and, as far as skins of birds are concerned, we have seen first-class specimens which have been made with no tools beyond a pocket-knife and a pair of stout nail-scissors. A useful chapter follows on preservatives, from which we observe that he objects to arsenical paste, which, he contends, does not protect the specimens from the larvæ of moths or beetles; and he recommends in its place a non-poisonous preservative soap consisting of chalk, soap, lime, and musk. Concise and careful directions are given of how to prepare skins and to mount specimens, and, as regards bird-skins, we have found Mr. Maynard's plan of wrapping a freshly prepared skin in a layer of cotton wadding to be the best mode, especially when the skins have to be packed at once. Full directions are also given for the modelling of rocks, trees, &c.; and respecting this we may say that we have found light peat most useful in the reproduction of rock-work, and have been able to make a very close copy of a natural piece of rock with it.

At the end of the book a carefully compiled bibliography of the works on the subject is given, and we are glad to see that Mr. Browne has made judicious use of most of them, especially those published in the United States, in the body of the work.

Mr. Browne is evidently a first-class taxidermist and well able to write with authority on the subject; and we can safely recommend the work to any one interested in the preparation of specimens. Some very good illustrations are scattered through the work, twenty-two of which are printed separately and eleven are printed in the text.

MISCELLANEOUS.

The Evolution of Lithocystis Schneideri, *a Parasite of* Echinocardium cordatum. By M. Louis Leger.

I had recently the opportunity of collecting, on the beach at Wimereux, a considerable number of *Echinocardia*, all of which contained *Lithocystis Schneideri*. I availed myself of it to study the evolution of this singular parasite, concerning which opinions are so divided, some regarding it as a Myxomycete, others as a pure

cœlomic form, others as an aberrant sporozoarium. The general aspect under which this parasite is actually known has been described by M. Giard, who discovered it in 1876. It consists of plasmodial masses of a blackish or violet colour, irregularly applied to the internal face of the test of the sea-urchin and enclosing spherical cysts containing numerous spores, appendiculate and with falciform corpuscles. Each cyst encloses besides a central spherical mass of tiny crystals of calcic oxalate.

Before seeking the origin of these cysts, I examined carefully the liquid of the cavities of a great number of sea-urchins, and I discovered in a great number of them monocystid Gregarinidæ, solitary or conjugated, free in the liquid. On continuing the investigation I succeeded in finding the various intermediate stages between the phase of young monocystid and the crystalline cysts of *Lithocystis*; in fact the gregarinid origin of these cysts was established.

The free gregarinid is difficult to see, especially when it is young, because it is not common and often concealed in the convolutions of the digestive tube. It is cylindrical in form, attenuated at the poles, and shows a beautiful striated contractile layer, with a large nucleus and a spherical nucleolus. The conjugate forms are easy to see from their size, their extremely active and complicated movements, and their curious method of copulation. The adult gregarinids measure more than 1·5 millim., so that they are readily distinguishable by the naked eye. In the conjugation, the attachment is not made between poles of the same or opposite name, as in the known forms, but by a small surface situate at about equal distance from the two extremities of the individual, as, for example, in *Diplozoon paradoxum*: this mode of conjugation, so far as I know, has never been observed in the Gregarinidæ. When the moment of encystment approaches, the two individuals take on a more massive form and their movements become gradually slower. It is at this period that the crystals are formed which are found later in the ripe cysts. To this end there appear on each individual numerous spherical clear vacuoles, in each of which a single crystal is formed, of the clinorhombic type, which appear to me, so far as microchemical analysis will show, to consist of calcic oxalate. When the encystment is complete, and the divisions of the nucleus and the protoplasm, which are to give origin to spores, begin to be effected, the vacuoles disappear and the crystals unite to form a common sphere in the centre of the cyst. These crystals, which appear at the beginning, in a kind of excretory vacuoles, ought, I think, to be regarded as a veritable excretory product of the gregarinid, a product which, having become useless or even a hindrance to the division of the protoplasm, is separated from the rest of the creature at the moment of reproduction. The presence of this product in the interior of the gregarinid is not at all surprising when one considers that the fluid in the general cavity of the *Echinocardium* contains a large proportion of salts of lime; it ought to be found in all the cœlomic gregarinids of Echinoderms with a calcareous test—a fact which I have already verified for *Spatangus lividus* from the

Mediterranean, in which I have found a new form of *Lithocystis*. The formation of crystals is not the sole interesting phenomenon which characterizes the evolution of this singular gregarinid. In fact at the moment when the gregarinids, closely attached and almost motionless, begin to encyst, the amœbocytes of the liquid in the cavity of the sea-urchin attach themselves closely to their surface and form a network with dense meshes, each of them putting out a free pseudopodium on the exterior directed normally to the surface of the cyst. All the pseudopodia are rigid and of equal length: this gives to the cyst a bristly appearance, very peculiar and at first sight very difficult to explain; but the cause is no longer in doubt when by a very slight compression of the cover-glass a great number of the phagocytes leave the surface of the cyst and form in its neighbourhood an elegant network by the anastomosis of their pseudopodia.

Afterwards the amœboid cells are crammed with pigment granules, take on an elongated form, and finally enter into a state of degeneration, forming blackish masses of plasmodial appearance, which surround the greater number of the cysts. Such is the origin of the supposed plasmodia of *Lithocystis*, in which an attentive study shows the amœbocytes in all stages: young, very active, with a well-marked nucleus; others already deformed and filled with pigment, the greater portion completely granular and degenerated. The parasitic product which is known under the name of *Lithocystis* is therefore complex. The cysts are those of a monocystic, cœlomic gregarinid of normal evolution, and the crystals are an excretory product; the coloured plasmodial masses are made up of a collection of the phagocytes of the *Echinocardium*, of which the greater part are dead and charged with granular pigment. By the form of its spores, the *Lithocystis* falls naturally into the family of the Urosporidæ, alongside the genera *Urospora* and *Ceratospora*, of the general cavity of the Siphunculidæ and the Synaptidæ.—*Comptes Rendus*, 1896, tom. cxxiii. pp. 702–705. (Studies from the Laboratory at Wimereux.)

On a Viviparous Ephemera. By M. Causard.

Viviparity is a condition relatively rare among insects. In fact it is only observed among the Strepsiptera, and exceptionally in the three orders of Hemiptera, Diptera, and Coleoptera. Among the first, many of the Aphidæ and the Cochinellidæ are viviparous for the parthenogenetic generations. Among the Diptera, the Pupiparæ, certain Muscidæ (*Tachina*, *Sarcophaga*), and several Œstrids parasitic on mammals; the pædogenesis of the larval forms of *Cecidomyæ* is also accompanied by viviparity. Lastly, among the Coleoptera there are only known certain Staphylinidæ which live as parasites in the ant-hills of South America (*Spirachtha*, *Corotoca*).

One would certainly not expect to encounter viviparity among the Ephemeræ, which have the reputation of living but a very short time in the adult state, a few hours at most, in certain species.

According to observers, these insects, as soon as born, copulate;